

2016 Wx Conference



Today's Agenda:

- Types of Manufactured Structures.
- Alterations of manufactured structures.
- Mechanical Systems.
- Water heaters.
- Envelope.

2016 Wx Conference



Presenter:

Jason Kelzer, Construction Code Representative.

With State of Minnesota since 2008.

- Manufactured Structures.
- Enforcement Services.
- Weatherization Monitor.



Types of Manufactured Structures



Types of Manufactured Structures:

- Industrialized/Modular Buildings (MSBC 1361)
- Pre-Fab Buildings (MSBC 1360)
- HUD Homes (MSBC 1350)

Types of Manufactured Structures



Industrialized/Modular and Pre-Fab:

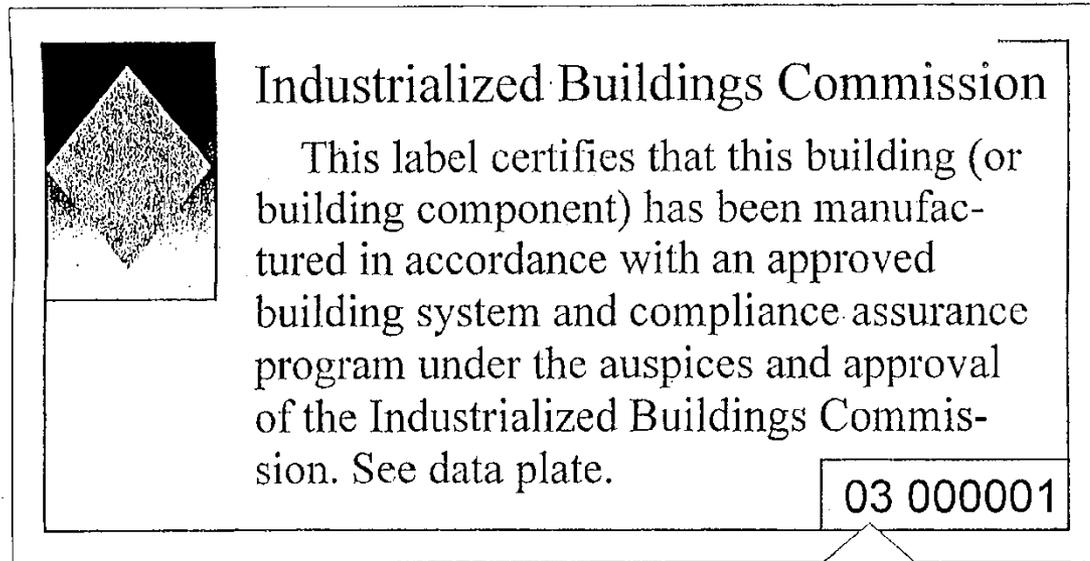
- Constructed to the Minnesota State Building Code.
- Site work must be done in accordance with the Minnesota State Building Code.
- Alterations must be done in accordance with the Minnesota State Building Code.

Types of Manufactured Structures



Industrialized/ Modular Buildings governed under MSBC Chapter 1361.

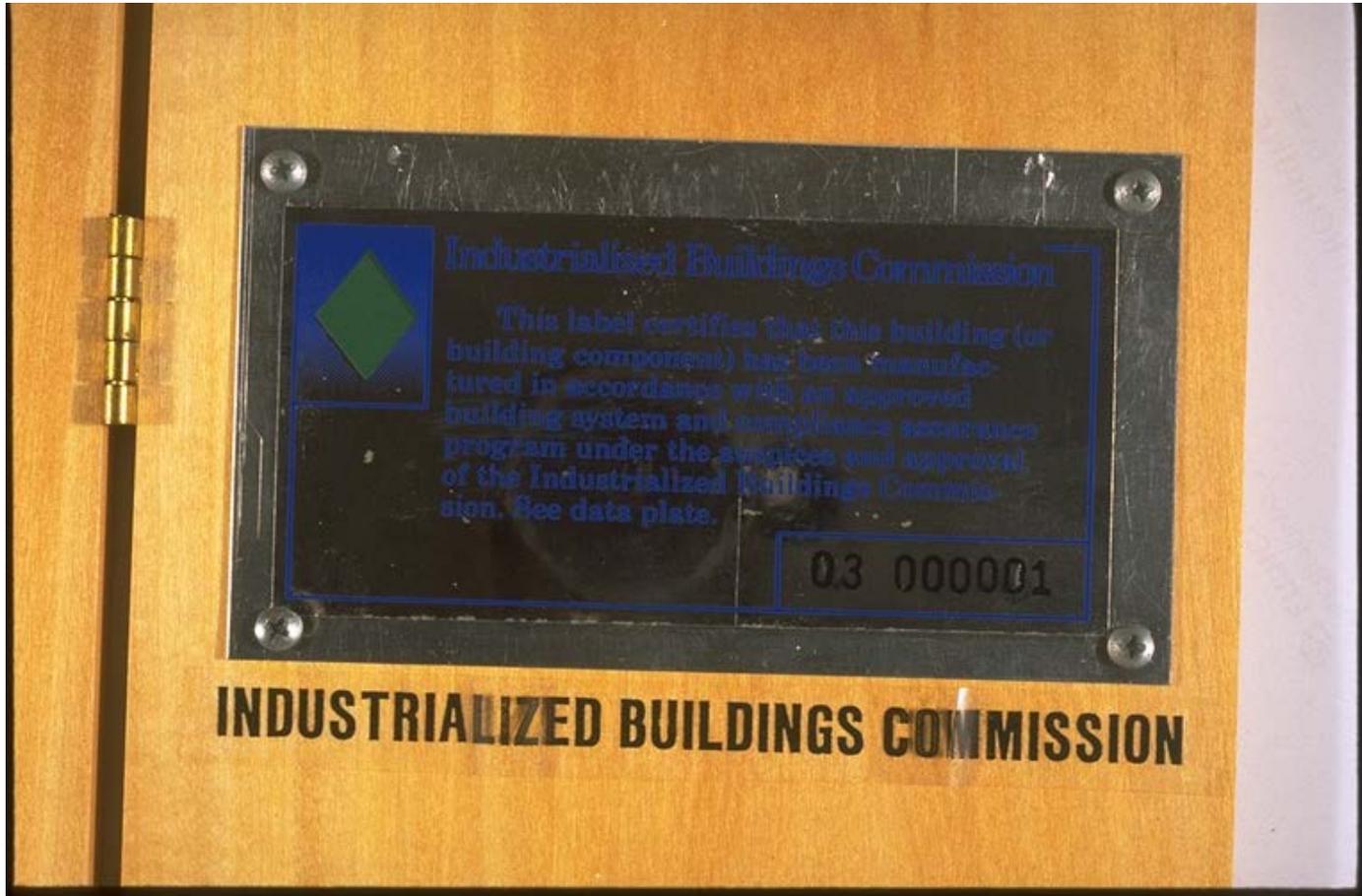
actual size 2" x 4"



Bright silver background with a green diamond in a blue rectangle.

First two digits indicate the inspection agency.

Types of Manufactured Structures



Types of Manufactured Structures



Our main focus today will be “Mobile” Homes.



Types of Manufactured Structures



3-terms used to identify manufactured homes:

- **Pre-code:** Manufactured prior to July 1, 1972. (voluntary construction to A119.1)
- **State code:** Manufactured from July 1, 1972 through June 14, 1976. (State inspection programs verified construction compliance to ANSI A119.1-NFPA 501B)
- **HUD code:** Manufactured from June 15, 1975 to the present. (HUD approved third party inspection to verify construction compliance to CFR 3280 Construction Standards and must follow CFR 3280 Enforcement Regulations)

Types of Manufactured Structures



Types of Manufactured Structures



Pre-Code Manufactured Homes.

- Homes were constructed prior to July 1, 1972.
- Were not required to be built or inspected to any recognized construction code (voluntary standard A119.1 – NFPA 501B).
- State and Federal Codes or Standards for construction of the home do not apply.
- Minnesota State Building Code (MSBC) Chapter 1350 installation code does apply.

Types of Manufactured Structures



Types of Manufactured Structures



State Code Manufactured Homes.

- Homes were constructed between July 1, 1972 and June 14, 1976.
- Constructed to ANSI A119.1 Standard (NFPA 501B).
- Inspected for construction compliance by individual states where built.
- Must have a State construction label attached to home. (Located on exterior of home near main entry door.)
- MSBC 1350 installation code (generic standard) does apply.

Types of Manufactured Structures



Types of Manufactured Structures



Typically located to the right of the main entry door at or above the floor level of the module.

- A permanent label shall be affixed to each transportable section of each manufactured home
- Manufactured home constructed after July 1, 1972 to June 15, 1976, for use as a dwelling unit
- Labels from other states are accepted (WI, IN, NE, IA, etc.)

Types of Manufactured Structures



Typically located to the right of the main entry door at or above the floor level of the module.

State code homes constructed to:

- ANSI A119.1, also known as NFPA 501B
- State code homes not required to have a data plate inside the home



American National Standards Institute



National Fire Protection Association (NFPA)



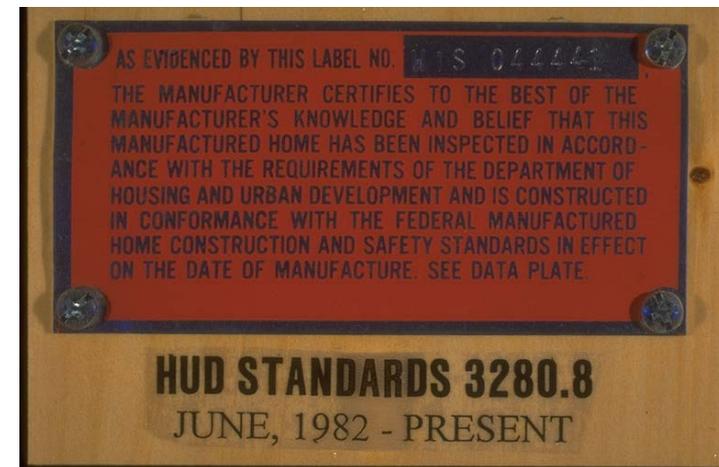
Types of Manufactured Structures



Types of Manufactured Structures



- Homes constructed from June 15, 1976 to present.
- Constructed to Code of Federal Regulations (CFR) 3280.
- Inspected for construction compliance by HUD approved independent third party agencies (IPIA)
- Must have a HUD issued, IPIA installed construction label attached on each section of the home at factory.
- Must have a DATA PLATE installed in each home.
 - Located on or near the electrical panel or other readily accessible location in a permanent manor.



Types of Manufactured Structures



- Data Plate must contain the following information:
 - Name and address of manufacturing plant.
 - Serial number and model designation of unit.
 - Date the unit was manufactured.
 - List of major factory-installed equipment/appliances.
 - List of the structural, wind, and heating zones the unit is designed to be located in.
 - Name of DAPIA approval agency.

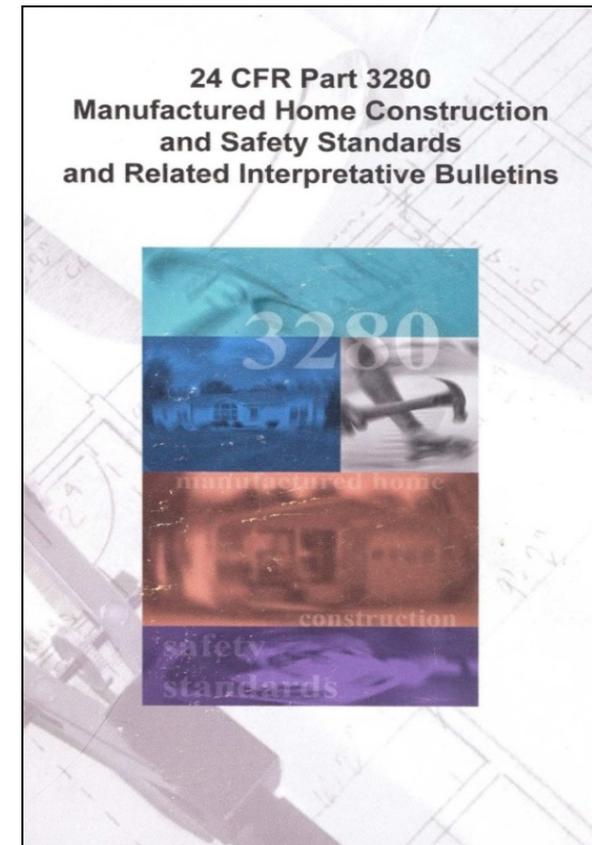
The image shows a manufacturer's data plate for a manufactured home, divided into several sections:

- COMPLIANCE CERTIFICATE:** Includes fields for Manufacturer Address, Date of Manufacture, HUD No., Plant Number, Manufacturer's Serial Number and Model Unit Designation, and Design Approval by (D.A.P.I.A.). It also contains a table for factory-installed equipment with columns for Equipment, Manufacturer, and Model Designation.
- HEATING AND COOLING DESIGN BASIS CERTIFICATE:**
 - COMFORT HEATING:** Details heating equipment manufacturer and model, average 70° F temperature, and maximum furnace operating economy.
 - COMFORT COOLING:** Details air conditioner manufacturer and model, certified capacity, and air distribution system.
- STRU'URAL DESIGN BASIS CERTIFICATE:**
 - DESIGN WIND ZONE MAP:** Shows a map of the United States with wind zones 1, 2, and 3. Zone 1 is Standard Wind (15 PSF minimum, 8 PSF Upset), Zone 2 is Hurricane Region (15 PSF minimum, 15 PSF Upset), and Zone 3 is Hurricane Region (15 PSF minimum, 15 PSF Upset).
 - DESIGN ROOF LOAD ZONE MAP:** Shows a map of the United States with roof load zones: North (45 PSF), South (30 PSF), Middle (30 PSF), and Other (30 PSF).
- INFORMATION PROVIDED BY THE MANUFACTURER:** A checklist of features such as built-in cupboards, built-in stoves, built-in refrigerators, built-in washers, built-in dryers, built-in garbage disposal, built-in fireplaces, built-in air conditioning, and built-in air distribution systems.

Types of Manufactured Structures



- Data Plate information continued:
- Data Plate dates of manufacture to note:
 - October 25, 1994, 3rd heating zone added to HUD CFR 3280 construction standards.
 - September 16, 2002, smoke alarm location requirements changed in HUD CFR 3280 construction standards



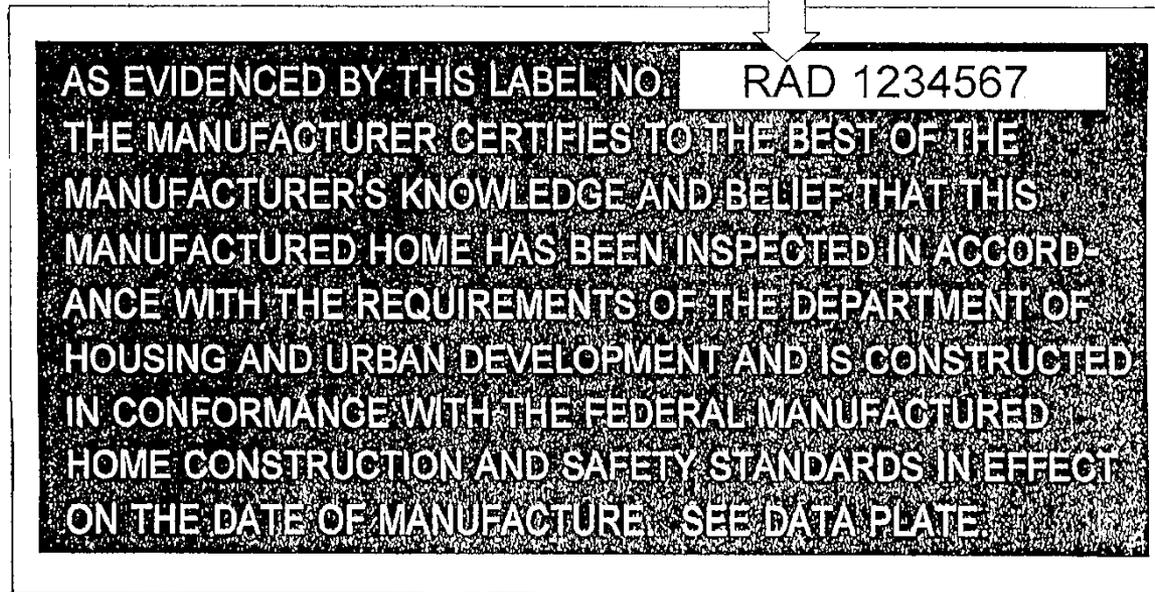
Types of Manufactured Structures



Manufactured Home - H.U.D. label

Located on the end of a unit;
one foot above the floor level
& one foot back from the corner of the unit.

First three letters indicate
the inspection agency.



June 1982; the term "Mobile Home"
was changed to "Manufactured Home".

actual size 2" x 4" approx.
Red in color.

Alterations



What is an Alteration??



Alterations



MSBC 1350.3800 ALTERATIONS

- Alterations are defined as changes to the manufactured home which affect the original:
 - Structural
 - Mechanical
 - Plumbing
 - Electrical
 - Fire Safety
 - Installation

- Alterations void the State or HUD construction labels on the home.

Alterations



Alterations



- Acts that do not constitute alterations:
 - Conversion of listed fuel-burning appliances in accordance with their listings
 - Replacement of equipment with “like” kind.
 - Repairs with approved components or parts
 - *(Note: A municipality may require permits and inspections for the above items.)*
- New manufactured homes still under warranty (MS 327B.02 and 327B.03) should not have alterations allowed.
 - Alterations to a new home may void warranties required by law.

Alterations



Alterations



Process for Alterations:

- Submit plans to LAHJ or DLI for approval.
- Inspections performed by LAHJ or DLI.
- Applies to homes “permanently” attached to property
- Alterations void construction label on HUD homes.
 - Replacement label must be obtained after alterations are inspected.
 - Must submit inspection report, copy of title, and application to DLI to receive replacement label.

Alterations



Appliances



Appliances

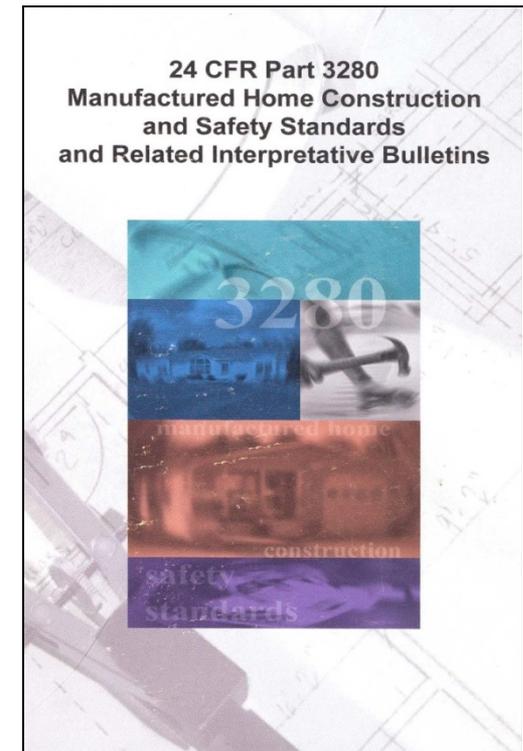


Appliances



Appliances (CFR) 3280.709

- Must be listed for use in a manufactured home.
- Will have listing label attached in permanent manor.
- Shall be both accessible and removable.
- Shall be secured in place to avoid displacement.
- Area surrounding shall not be used for storage.



Appliances



Can we change the water heater access location?



Appliances



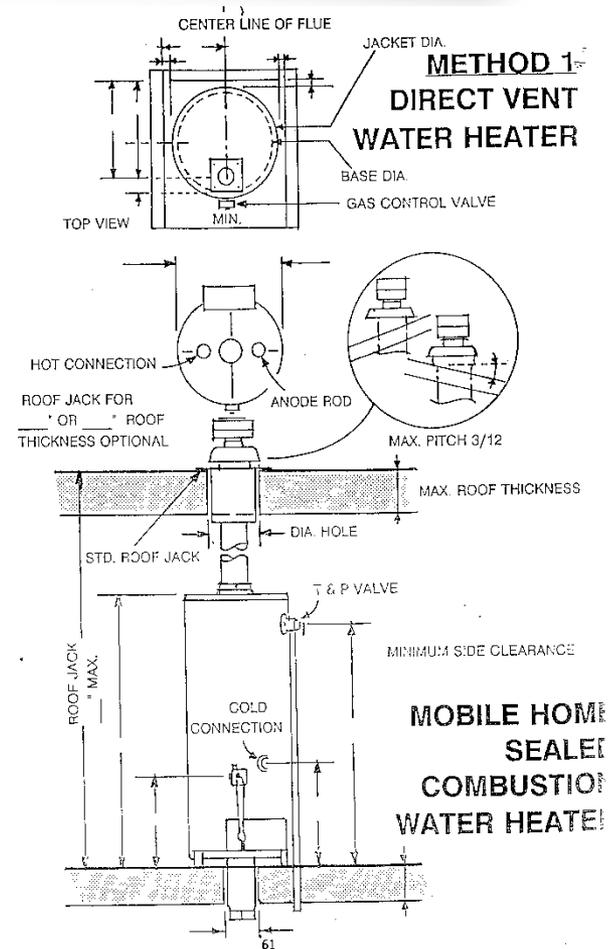
CFR 3280.709

Gas furnaces, water heaters, or fireplaces shall provide complete separation of the combustion system from the interior atmosphere of the home by one of two methods.

Appliances



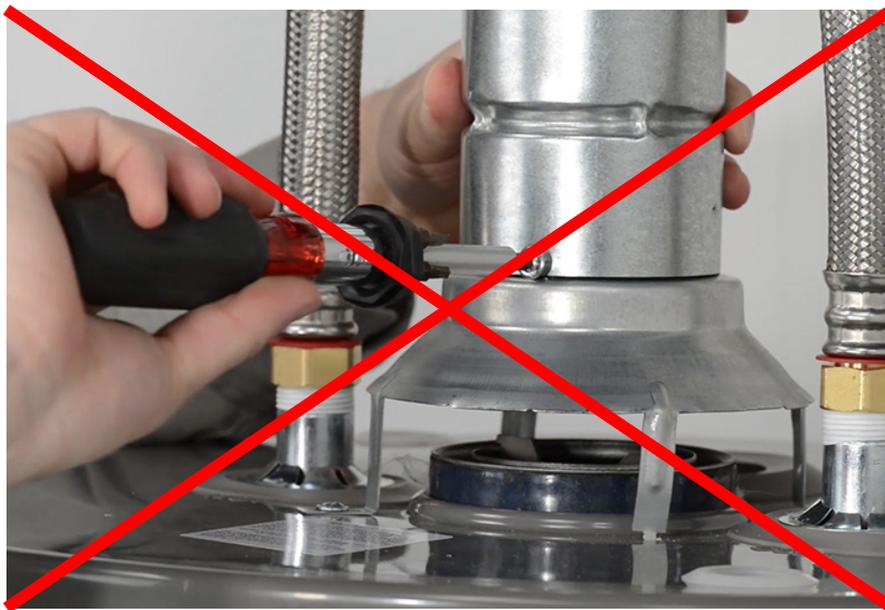
Method #1 is the installation of direct vent/sealed combustion system.



Appliances



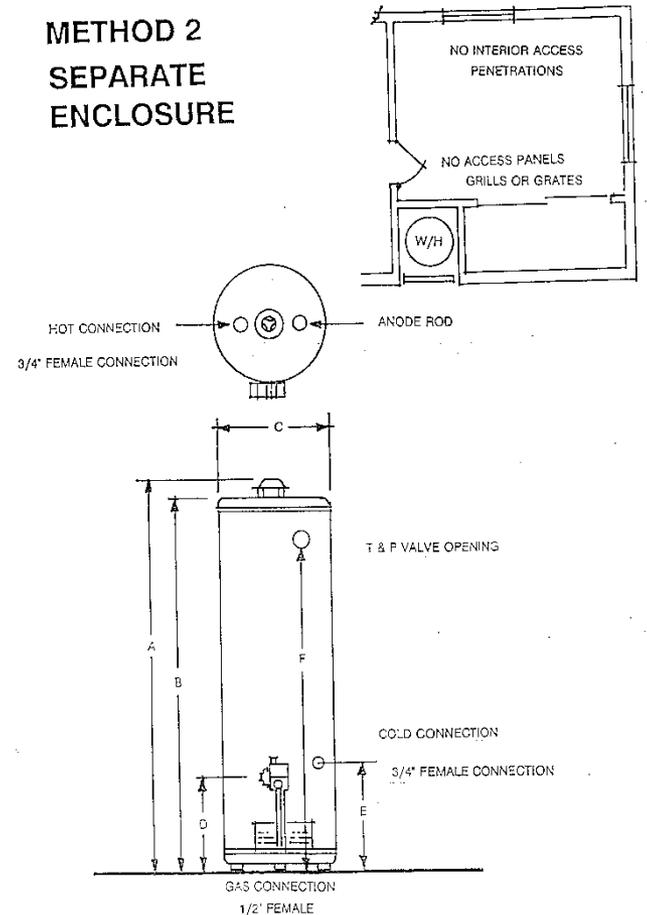
Direct Vent/Sealed Combustion



Appliances



Method #2 is the installation of appliances within enclosures so as to separate the combustion and venting systems from the interior atmosphere of the home. No door, removable access panel or other opening into the enclosure from inside the home is allowed. Any opening for ducts, wires, pipes etc. shall be sealed.



Appliances



CFR 3280.203 (3)

Walls adjacent to or inclosing a furnace or water heater and the ceilings above them shall have a flame spread rating of not more than 25.



Appliances



When replacing furnace or water heater, the flue assembly must be:

- 1) An integral vent system listed or certified as part of the appliance. Or
- 2) The vent system must consist entirely of listed components and be installed in accordance with the appliance manufacturers instructions.

Replace furnace = replace stack!

Appliances



Testing:

- Drilling and testing of Flue shall not be done unless approval is granted by the flue manufacturer.
- Manufacturer will give requirements for sealing test hole.



Appliances



Furnace Replacement:

- Unit shall be listed for use in manufactured home.
- Unit shall be sized according to data plate or shall be same as original unit.
 - If altering the thermal envelope of the home, a Manual J calculation should be completed with the new R or U Values.
- Condensate shall be properly routed to sewer system if High Efficiency furnace is installed.
 - May need condensate pump to direct condensate to stand pipe or floor drain.



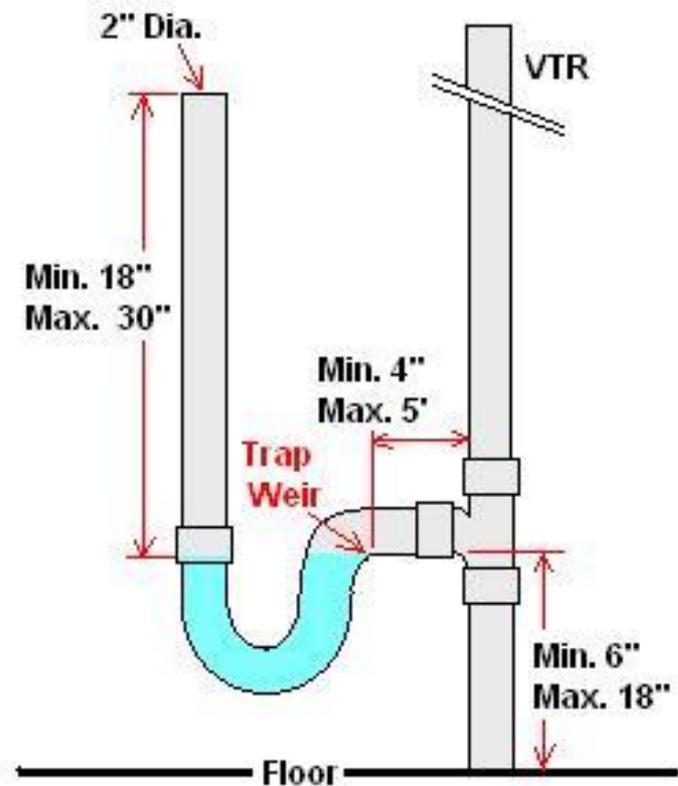
Appliances



Appliances



- Properly designed stand pipe.
- May be able to pump condensate to laundry area.
- Air gap should be provided at standpipe.



Appliances



Furnace Replacement:

- May require Manual D calculation to verify ductwork sizing.
 - High Efficiency furnaces may require more air movement and possibly larger ducts to insure proper operation of the furnace.
- Blend Air/VentilAire system must be re-connected if in working order.

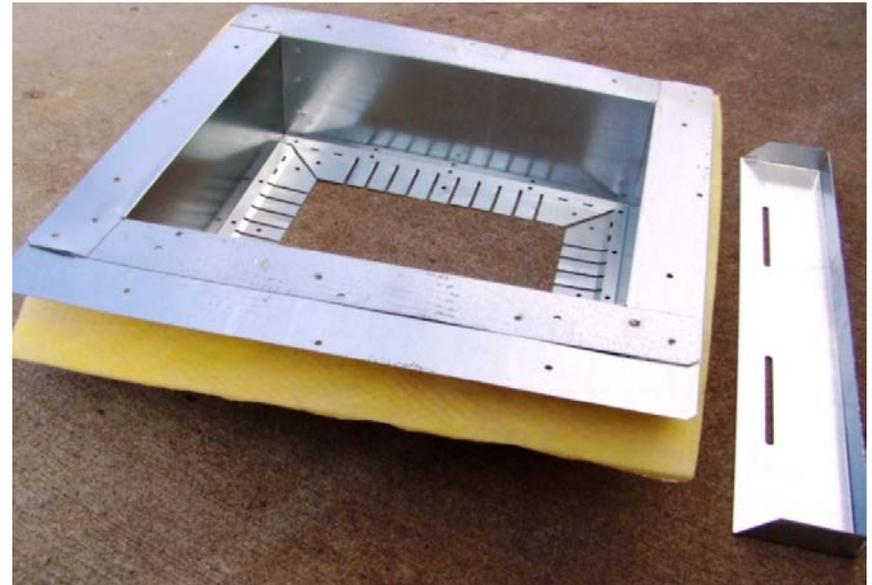


Appliances



Duct Connectors/Furnace Boots:

- Must be compatible with replacement furnace.
- Must be in good condition.
- Must be sealed to furnace enclosure and “substantially airtight”.

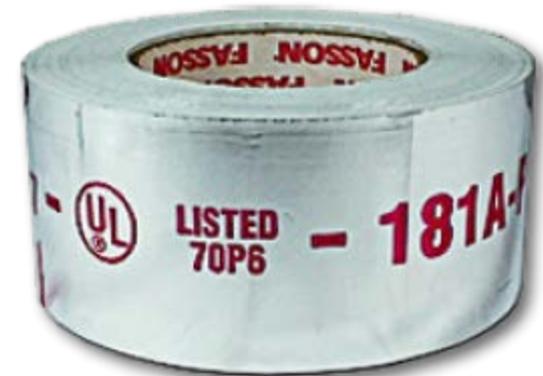


Appliances



Ductwork:

- Ducts shall be considered substantially airtight when the static pressure in the duct system reads at least 80% of the static pressure at the furnace compartment.
- Sealing of ductwork shall be done with mastic or tape meeting UL 181 standards.
 - Metal to Metal connections?
- Joints of ductwork shall be mechanically secured.

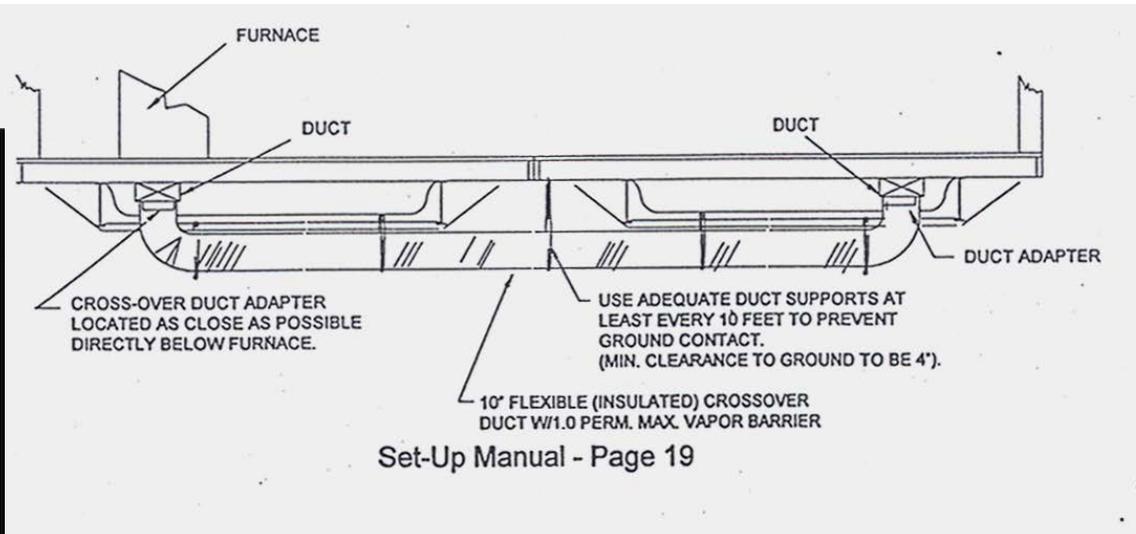


Appliances



Crossover Ducts:

- Shall be supported in accordance with duct manufacturers instructions.
- Shall have R-8 insulation and a vapor barrier.

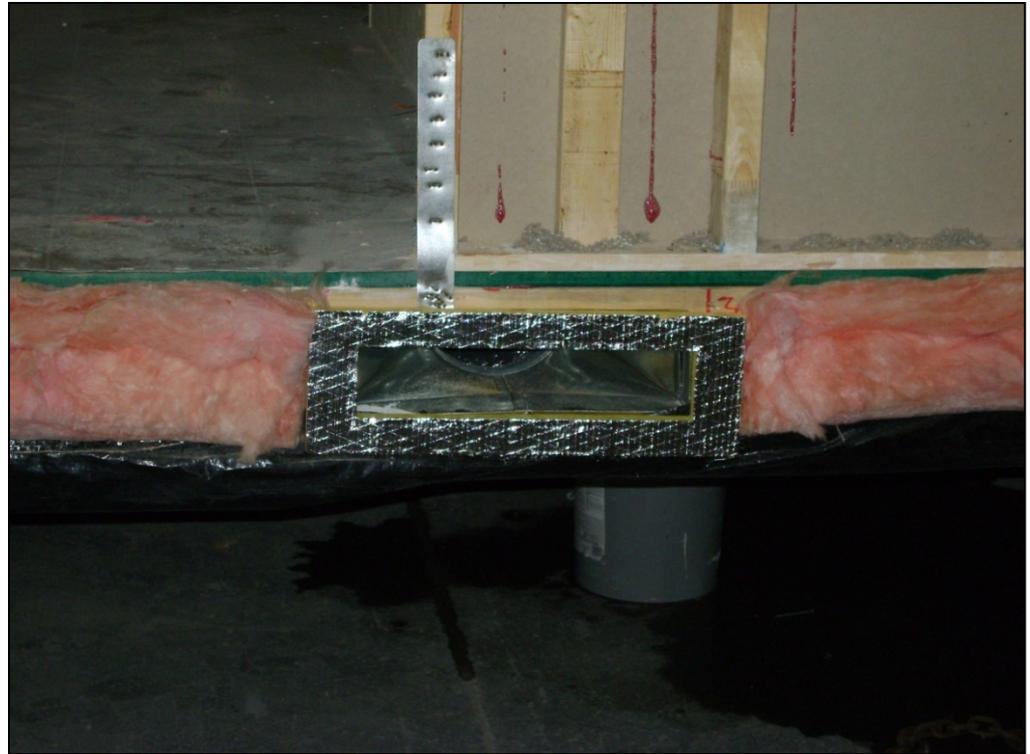


Appliances



Crossover Ducts:

- Some manufacturers run crossovers thru rim joist areas. These should be air tight.



Appliances



Sizing of Ductwork:

- Ductwork sized for original equipment.
- Issues may arise:
 - When switching to 90%+ furnace
 - Switching to ECM Motors.
- May be beneficial to perform new manual D calculations to verify ductwork is adequate.
- Alternatives to Manual D.
 - Static pressure within Manufacturers Specifications.
 - Temp rise within Manufacturers Specifications..

Appliances



Blend Air/VentilAire Systems:

- Standard system provides fresh air into the home.
- “Deluxe” or “II” systems provide fresh air into the home and ventilates the attic space.

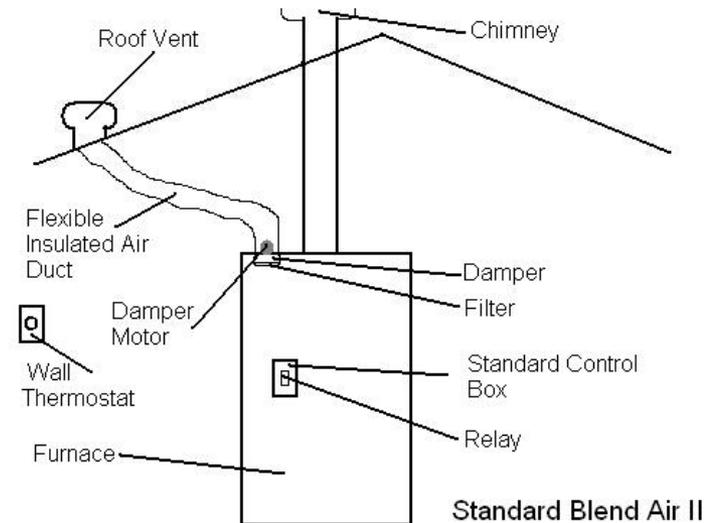


Appliances



Standard Blend Air/VentilAire Systems:

- Utilizes furnace fan to provide fresh air to home.
- Damper and filter in furnace enclosure.
- Most issues arise from plugged filter or faulty damper.
- Stale air is exhausted out roof, fresh air enters thru passive opening in wall or roof.



Appliances



Standard Blend Air/VentilAire Systems:

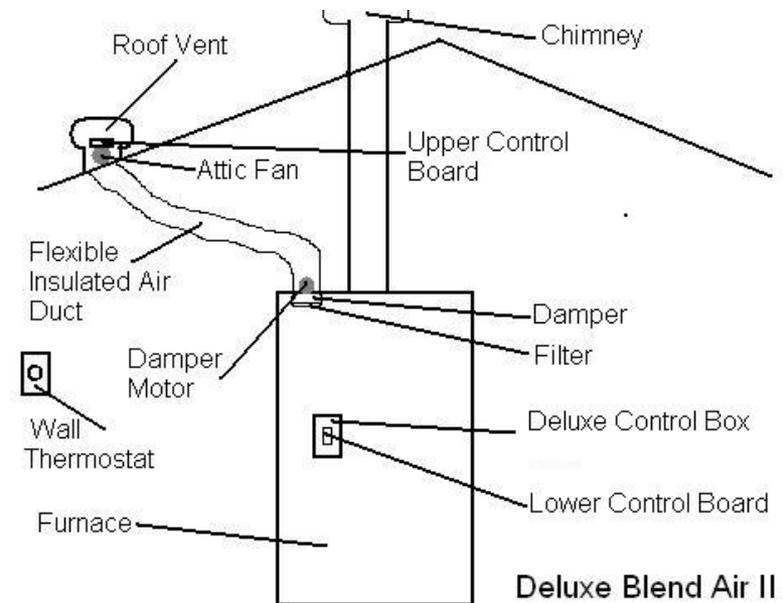


Appliances



Deluxe Blend Air/VentilAire II Systems:

- Utilizes furnace fan to provide fresh air into home.
- Damper and filter in furnace enclosure.
- Contains additional fan and control board on roof.
- Fresh air is provided to home only when furnace is operating.

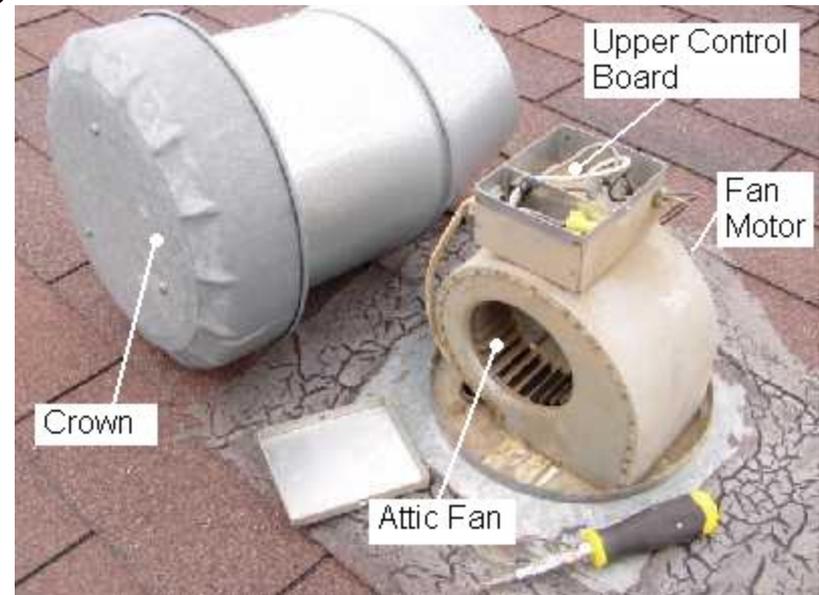


Appliances



Deluxe Blend Air/VentilAire Systems:

- More complex system, harder to diagnose issues.
- Attic fan runs 4 out of every 8 hours.
- Fan on roof provides attic ventilation to attic space to remove moisture thru vents in roof.



Ventilation



ASHRAE 62.2 (2013):

- Do Existing Blend Air/VentilAire systems meet the requirements of ASHRAE 62.2?

- Answer is..... Depends!

Ventilation



Calculation of required ventilation air:

Option 1: The Formula

If you want to install the minimum ventilation capacity, use these steps to follow the formula option.

1. Determine the floor area of the conditioned space of the home in square feet (A_{floor}).
2. Determine the number of bedrooms (N_{br}).
3. Insert these numbers in the formula below.

$$\text{Fan Airflow(CFM)} = 0.03A_{\text{floor}} + 7.5(N_{\text{br}} + 1)$$

From ASHRAE Standard 62.2-2013 equation 4.1a.

Ventilation



Calculation of required ventilation air:

$$\text{Fan Airflow(CFM)} = 0.03A_{\text{floor}} + 7.5(N_{\text{br}} + 1)$$

From ASHRAE Standard 62.2-2013 equation 4.1a.

Option 2: The Table

You can also determine the fan airflow under ASHRAE 62.2–2013 using the table shown here. This option will always provide a higher ventilation rate than the formula.

Refer to the *ASHRAE standard* for more details, guidance, and exceptions that are beyond the scope of this field guide. *Residential Energy Dynamics* provides a free online tool to help calculate ASHRAE 62.2-2013 ventilation rates. *Heyoka Solutions* has a spreadsheet that aids in these calculations.

Ventilation



Table 4.1 CFM Requirements for Whole-Building Ventilation

Floor Area (ft ²)	Number of Bedrooms				
	1	2	3	4	5
<500	30	38	45	53	60
501–1000	45	53	60	68	75
1001–1500	60	68	75	83	90
1501–2000	75	83	90	98	105
2001–2500	90	98	105	113	120
2501–3000	105	113	120	128	135
3001–3500	120	128	135	143	150
3501–4000	135	143	150	158	165
4001–4500	150	158	165	173	180
4501–5000	165	173	180	188	195

Fan flow in CFM. From ASHRAE Standard 62.2-2013, Table 4.1a

Ventilation



- BlendAir and VentilAire systems only supply fresh air to the interior of the home when the furnace fan is operating.
- Use Table 4.2 in ASHRAE 62.2 for the “correction factor”
- Percentage of run time will vary with the outside Temp.

TABLE 4.2
Ventilation Effectiveness for Intermittent Fans

Daily Fractional On-Time, f	Ventilation Effectiveness, ϵ
$f \leq 35\%$	0.33
$35\% \leq f < 60\%$	0.50
$60\% \leq f < 80\%$	0.75
$80\% \leq f$	1.0

Ventilation



- Blendair/VentilAire systems average around 80-90cfm for interior air flow.
- This is based on the speed of the furnace blower.
- Deluxe Blendaire/VentilAire systems provide about 150cfm for attic ventilation

Evcon Furnaces			
Living Area			Attic Area
Gas	DGAA, DGAH	90 CFM†	150 CFM†
Oil	DFAA, DFAH		
Electric	EB	80 CFM†	

Ventilation



Example 1: December.....Brrrrrrr!

16 x 70 singlewide with 3 bedrooms.

$16 \times 70 = 1120$ sq. ft.

Fan Airflow = $0.03(1120) + 7.5(3+1)$

Required fan airflow = 63.6cfm

Gas Furnace blower = 90cfm

Operating 75% of the time?

$90 \times .75 = 67.5$ cfm



Ventilation



Example 2: May.....Nice!

16 x 70 singlewide with 3 bedrooms.

$16 \times 70 = 1120$ sq. ft.

Fan Airflow = $0.03(1120) + 7.5(3+1)$

Required fan airflow = 63.6cfm

Gas Furnace blower = 90cfm

Operating 30% of the time?

$90 \times .30 = 27$ cfm



Ventilation



- Credits may be calculated in for building leakage.
- Amount of ventilation depends on seasonal factors.
- Amount of ventilation provided depends on habits of occupants.
- Air changes will be affected by maintenance of system.

Ventilation



Sooooo....

Does a Blendair/VentilAir system meet the ventilation requirements of ASHRAE 62.2?

Depends on the season and habits of the occupants!



Ventilation



How do we meet 62.2 year round?

Can a continuous fan be installed in a manufactured home to meet 62.2?

- Continuously operating exhaust fan and passive air intake may be installed to meet the ventilation requirements.

Thermal Envelope



Thermal Envelope



Insulation:

- Insulation may be added to attic spaces.
 - Ceiling finish must be in good condition and able to support additional weight.
 - Air space must be left in ventilated attic spaces.
 - If non-vented roof systems, roof must be sealed to prevent moisture or condensation issues.



Thermal Envelope



Insulation:

- Insulation may be added to the under floor area:
 - Belly material must be in good condition and able to support additional weight.
 - Some manufacturers design air space in belly as a semi-conditioned space to run plumbing, filling this air space may create issues with freezing pipes.



Thermal Envelope



Insulation:

- Insulation may be added to the under floor area:
 - Belly material must be repaired where access is made to install insulation.
 - Adding insulation above original amount specified on Data plate may constitute an alteration.



Thermal Envelope



Bottom Board Repair:

- Bottom Board shall be repaired with an approved material.
- Bottom Board Material must meet the Beach Puncture Test.



Thermal Envelope



Insulated Skirting:

- May be installed around perimeter of home.
- Does not replace the need for in-floor insulation.
- Under floor area will not be conditioned space.
- May be susceptible to frost heave.
- Currently not allowed in Wx Program!



Thermal Envelope



Window Replacement:

- Shall be listed for use in a manufactured home.
 - Not as strictly enforced as it used to be.
- Shall not take the home out of compliance with the U value calculations noted in CFR 3280.508
- Change in rough opening size would constitute an alteration.

Thermal Envelope



Window Replacement:

- Must meet egress requirements of CFR 3280.106 & 3280.404
 - Bottom of window shall not be more than 36” above floor.
 - Locks, Latches and operating handles shall not be more than 54” above floor.
 - 20” minimum width, 24” minimum height, not less than 5 square feet of openable area.

Thermal Envelope



Door Replacement:

- Change in rough opening size would constitute an alteration.
- Some manufacturers require additional support for doors 3' or greater.



Installation



Installation



Reasons to look at installation items:

- Durability of Wx Products.
 - Moisture from leaks, wet underfloor areas.
 - SIR/Return on Investment.
- Safety of Wx Workers.
 - Improperly installed homes can be dangerous to workers.
- Operation of egress windows/doors.
 - Windows & doors installed in un-level home may not function properly.
- Optimal energy savings.
 - Wet insulation does not work!!

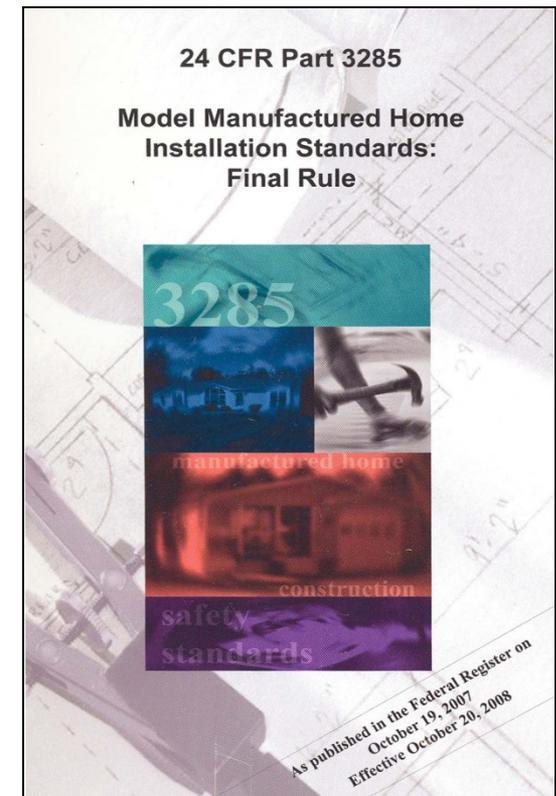


Installation



Construction Safety Act of 2000.

- CFR 3285
- Bottom of footings must extend below frost line depth, unless designed for placement above the frost line. Alternate designs to frost depth requires DAPIA approved drawings of MN Engineers design.
- Used homes may be ground set.
Bulletin #44



Installation



- Installation seals and certificates are required for all manufactured homes installed in MN, including those in a municipality enforcing the MSBC

Minnesota Department of Labor and Industry
Construction Codes and Licensing Division
Plan Review/Inspections
443 Lafayette Road North
St. Paul, MN 55155-4341
Phone: (651) 284-5068 Fax: (651) 284-5749
www.dli.state.mn.us TTY: (651) 297-4198

Reset

Manufactured Home Installation Compliance Certification

Mail a copy to MN CCLD within 7 days of completion of installation.

General Information

HOMEOWNERS NAME _____ COUNTY _____

HOME LOCATION/ADDRESS _____ CITY _____

MANUFACTURED HOME BRAND _____ MODEL _____ SERIAL NUMBER OF HOME _____ DATE OF MANUFACTURE _____

HUD or STATE LABEL(S) NUMBER (S) (If home was manufactured prior to July 1, 1972, no label number required.) _____

Is the home located in a park? Name of Park _____
 No Yes

Building Permit Required? _____ Inspection of installation completed? _____
 No Yes City or County No Yes City or County

Support System

Support System Seal Number: Foundation Type: Ground Block Frost Depth Piers Basement Crawlspace w/frost fig.
 Engineered Slab Other Approval Alternate Alternate approval number: _____
 Soil Bearing Capacity (p.s.f.) _____ Method of verification _____ DATE OF INSTALLATION _____

Support System Items of Utility Work: (Enter completed by, if installer state installer, if homeowner state homeowner, if other give name of person, company name, license number if known.)

Sewer: _____ Tested: _____
 Water: _____ Tested: _____
 Gas: _____ Tested: _____
 Electrical: (By licensed electrical contractor or homeowner for electrical items.) _____ Tested: _____

Other Items Included in Installation

Home Stand/Pad Lot grading
 Other Items: _____

I hereby certify that the Support System instructions and the Minnesota State _____
 MN REGISTRATION NUMBER (IN _____
MI. _____

Anchoring System

Anchor System Seal Number: ANCH _____

A1-

Soil Anchors Test Probe Torque _____
 No Yes

I hereby certify that the Anchoring System instructions and the Minnesota State _____
 MN REGISTRATION NUMBER (IN _____
MI. _____

If anchoring of the home completed by _____

This material can be made available (DIAL-DLI) Voice or TDD (651) 297-4 _____
 MS Certification (506)



Installation



CFR 3286.505

Minimum elements to be inspected.

- Site location and consideration of site specific conditions,
- Site preparation,
- Foundation construction and anchorage,
- Installation of optional features, (including on-site items)
- Completion of systems (mechanical, plumbing, electrical, etc.),
- Exterior and interior close-up,
- Completion of operational checks and adjustments.

Installation



3285.6

The home will be considered adequately leveled if there is no more than $\frac{1}{4}$ inch difference between adjacent pier supports (frame or perimeter) and the exterior doors and windows of the home do not bind and can be properly operated.

3285.102

Manufactured homes located wholly or partly within flood hazard areas must be installed on foundations engineered to incorporate methods that minimize flood damage in accordance with the requirements of the LAHJ.

Installation



3285.203

Drainage must be provided to direct surface water away from the home. When sited the home must be protected from surface runoff from the surrounding area.



Installation



3285.304

- Concrete blocks shall have nominal dimension of at least 8" x 8" x 16"
- Concrete blocks shall be stacked with their hollows cells aligned vertically and be a structural block at least equal to an ASTM C-90 N-1 block
- Caps shall be of solid masonry at least 4" thick or dimensional lumber at least 2" nominal thickness or of steel.

Installation



3285.304

- Shims shall be nominal 4" x 6" and used in pairs to fill gaps between the pier cap and the home's structural member.
- Shims shall not exceed 1" in height.
- Hardwood plates used to fill gaps between the pier cap and the home's structural members shall not exceed 2"

Installation



3285.204

If the space under the home is enclosed with skirting or other materials, a vapor retarder must be installed to cover the ground. Vapor retarder material is a minimum 6-mil polyethylene sheeting or equal.

3284.505

Crawlspace ventilation with skirting must be provided at the rate of 1 square foot per every 150 square foot of floor area unless a minimum 6-mil poly is used to cover the ground in the crawlspace area. If 6-mil poly is used ventilation may be reduced to 1 square foot for every 1,500 square foot of floor area.

Installation

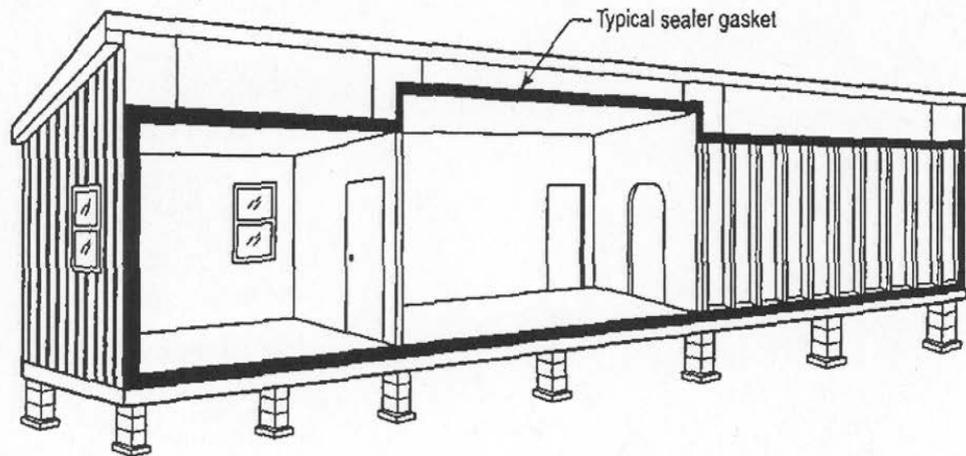


Installation



3285.801

An Air infiltration Gasket shall be installed between sections of the home per manufacturers instructions.



Note: On multisection manufactured dwelling, install sealer gasket on the ceiling, endwalls, and floor mating line prior to joining the sections together.

FIGURE 7.7.1.3 Mating Line Gasket Installation.

Very Mobile Home



Contact Information



Section Staff

Randy E. Vogt	651.284.5875	Section Chief
Dennis Lass	651.284.5840	
Larry Johnson	651.284.5894	
Jason Kelzer	651.284.5841	
Herman Hauglid	651.284.5870	

www.dli.mn.gov

Phone 651.284.5092

Fax: 651.284.5749

443 Lafayette Road N., St. Paul, MN 55155



5 C's?



Comments?
Concerns?
Compliments?
Complaints?
Questions?



The End.....

